EPA's New Program for Clean Nonroad Diesel Engines & Fuel

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U.S. EPA

Clean Air Act Advisory Committee Meeting

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3 Milestone EPA Programs

- Tier 2 Light-Duty Vehicle Program

- 2007/2010 Heavy-Duty Highway Program

- Tier 4 Nonroad Diesel Program

Phase-In of New Mobile Source Programs

Light-duty
Tier 2

vehicles

gasoline

Heavy-duty
highway

diesel fuel

engines

Nonroad
Tier 4

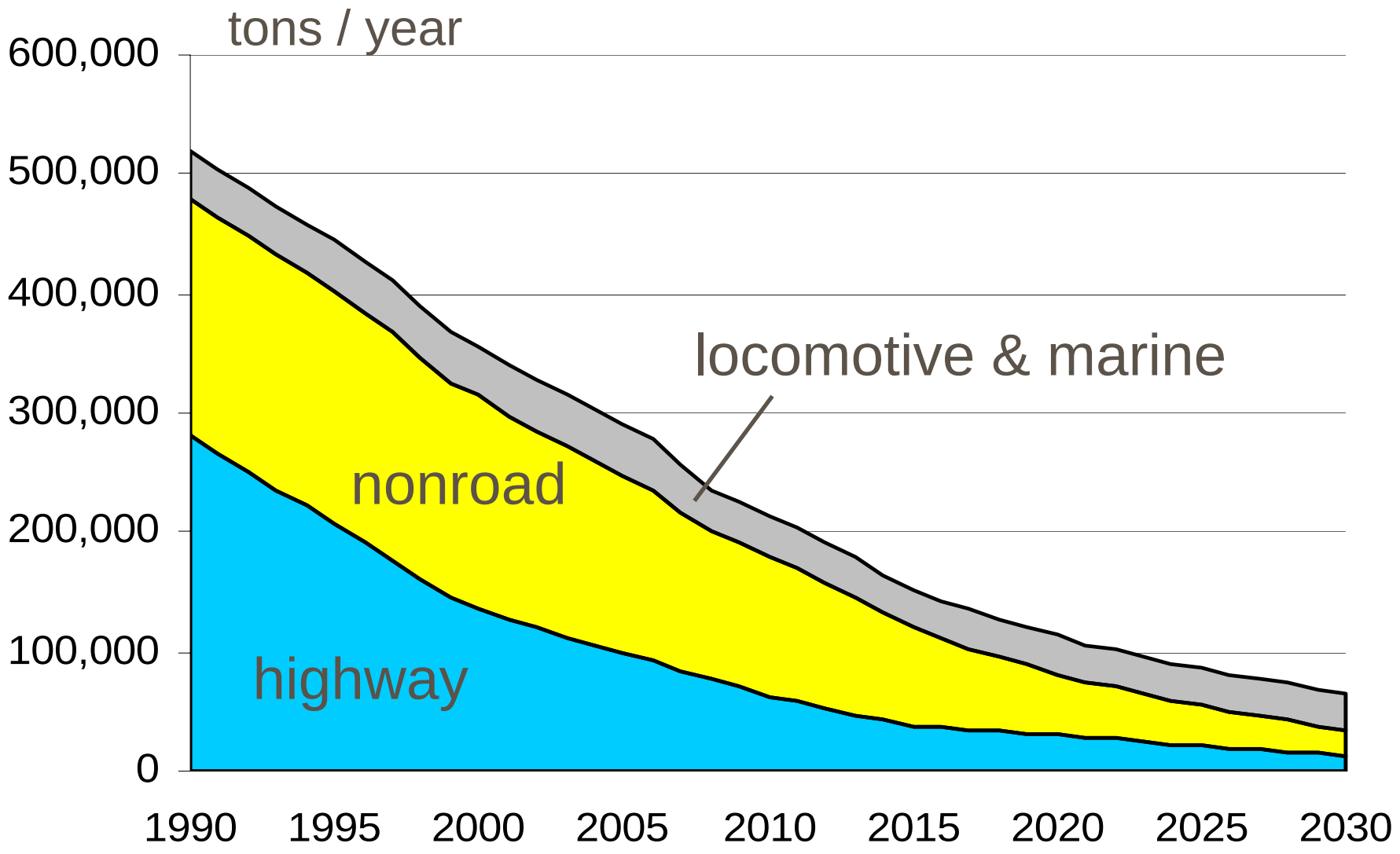
engines

diesel fuel: 1st step

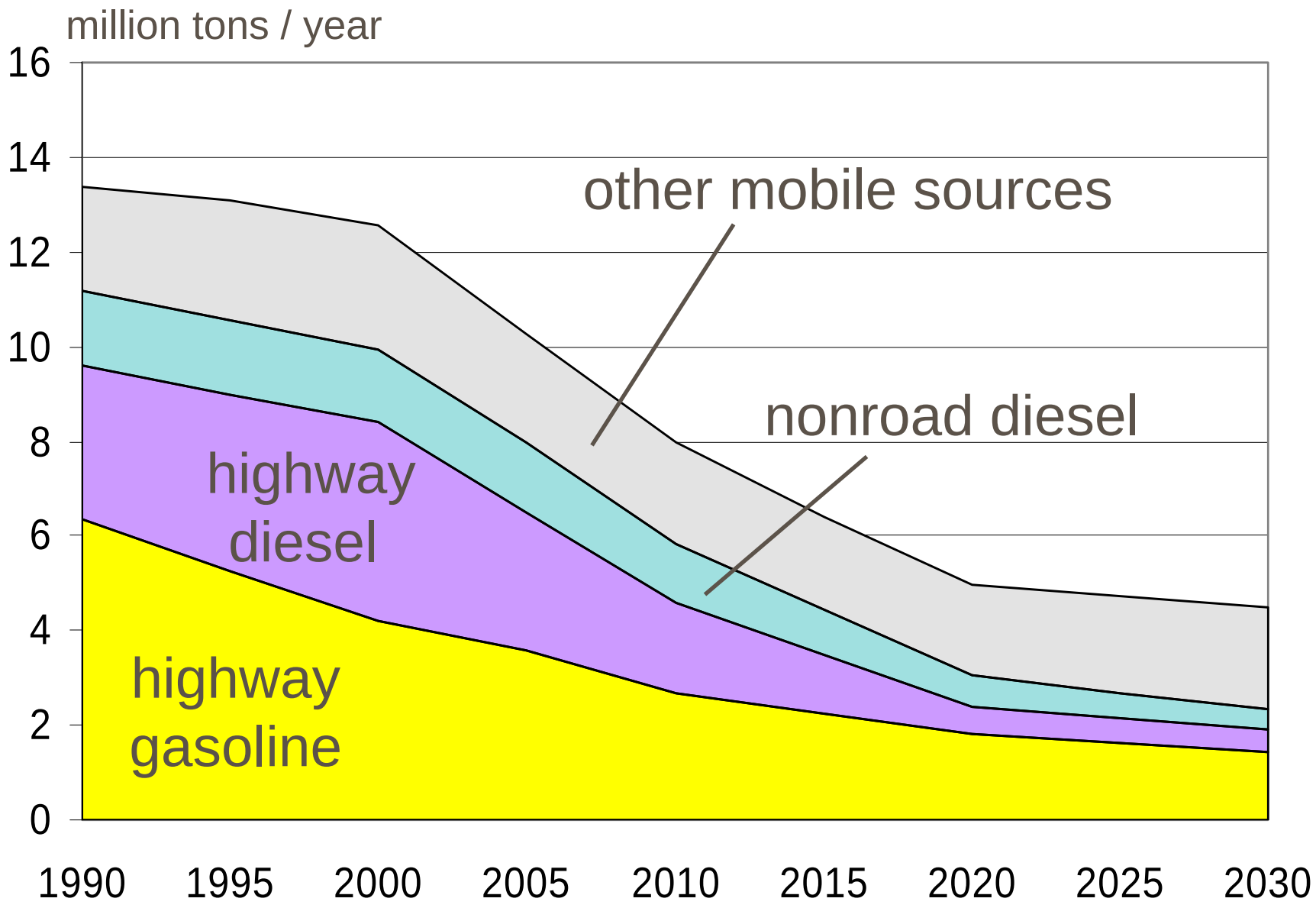
2nd step

2000 2002 2004 2006 2008 2010 2012 2014 2016

Impact of Mobile Source Programs on Diesel $PM_{2.5}$



Impact of Mobile Source Programs on NOx Emissions



Designing a Program to Control Nonroad Diesel Emissions Presented Some Challenges

- Engines vary from 3 to 3000 hp
- Used in thousands of machine models
- High hurdles for emissions controls--
  - Users demand rugged machines
  - Must work in extreme conditions
- Nonroad diesel fuel is currently unregulated
  - Has ~3000 ppm sulfur (10 x more than highway fuel)
  - Harms sulfur-sensitive control technologies

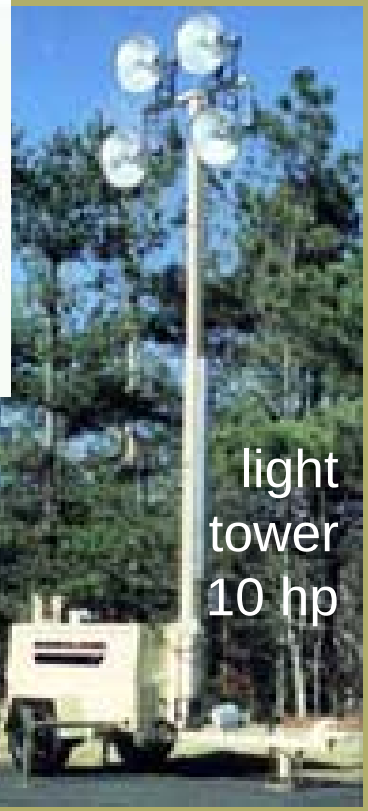
skid steer
loader 80 hp

backhoe
loader 80 hp

2WD tractor
130 hp

genset 20 hp

utility vehicle 18 hp



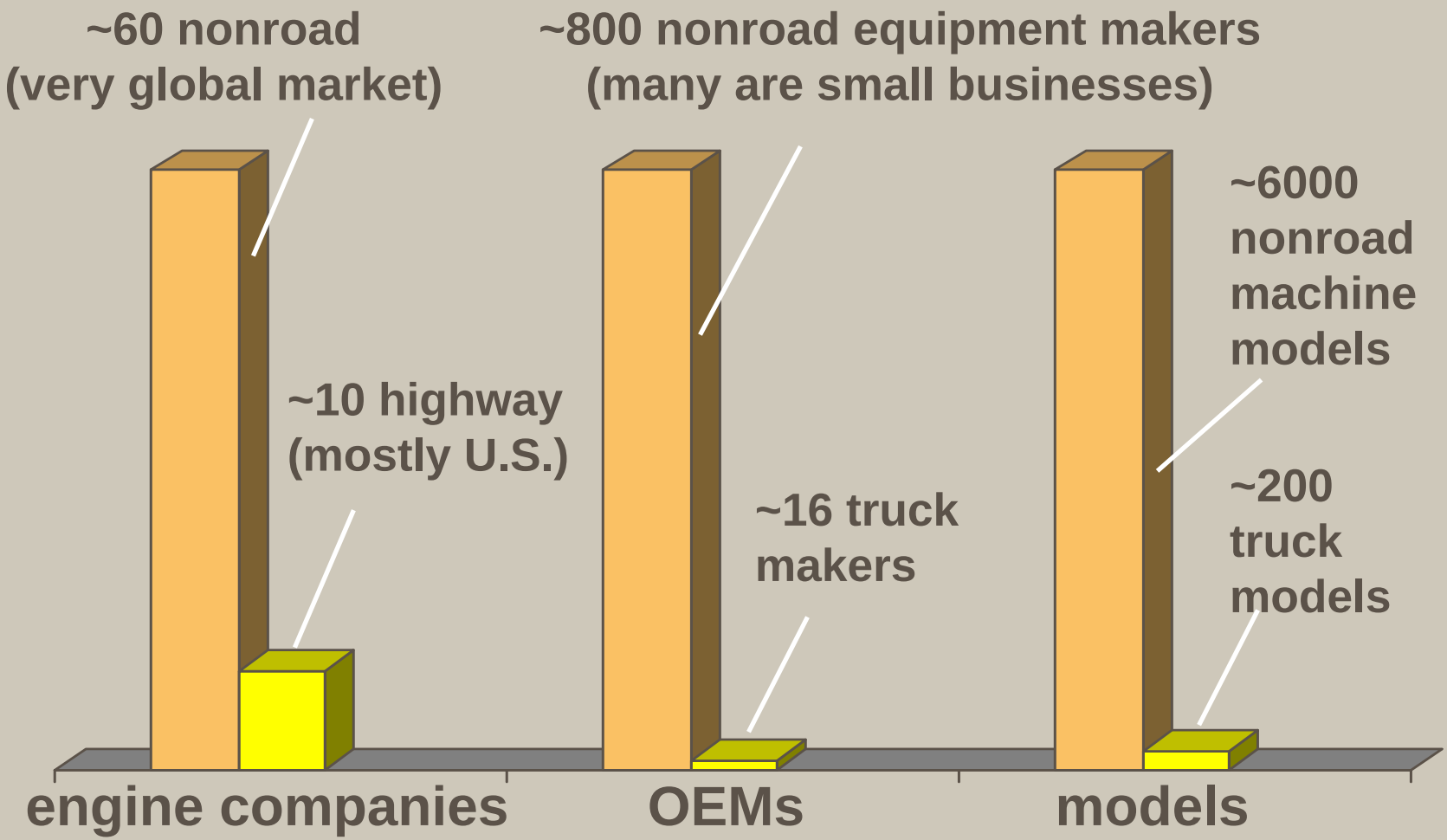
light
tower
10 hp

combine 285 hp

off-highway truck
1000 hp

Wide Range of Diesel Machines

Nonroad Diesel Industry is Very Diverse



Program Considerations

- Treat the diesel fuel and engine as a system.
- Transfer advanced technology from 2007 highway program to nonroad applications.
- Get timely, large emission reductions to help States' attainment and maintenance plans.
- Provide 6-10 years lead time to deal with technical challenges and diversity of industries & products covered.
- Include flexibility provisions to minimize costs.
- Align with implementation of 2007 highway diesel program (put in place by EPA in 2001).

Nonroad Diesels: An Effective Collaboration

- Program success keyed to extensive outreach done by EPA with all stakeholder groups
  - State and local governments
  - Environmental and public health organizations
  - Engine and equipment manufacturers
  - Oil industry
  - Emissions control manufacturers

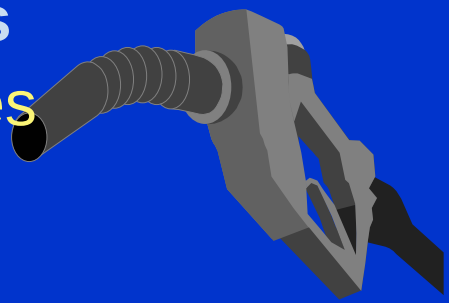
- Final rule has received widespread support

A Systems Approach-- Fuel & Engines

Patterned after the 2007 highway diesel rule:

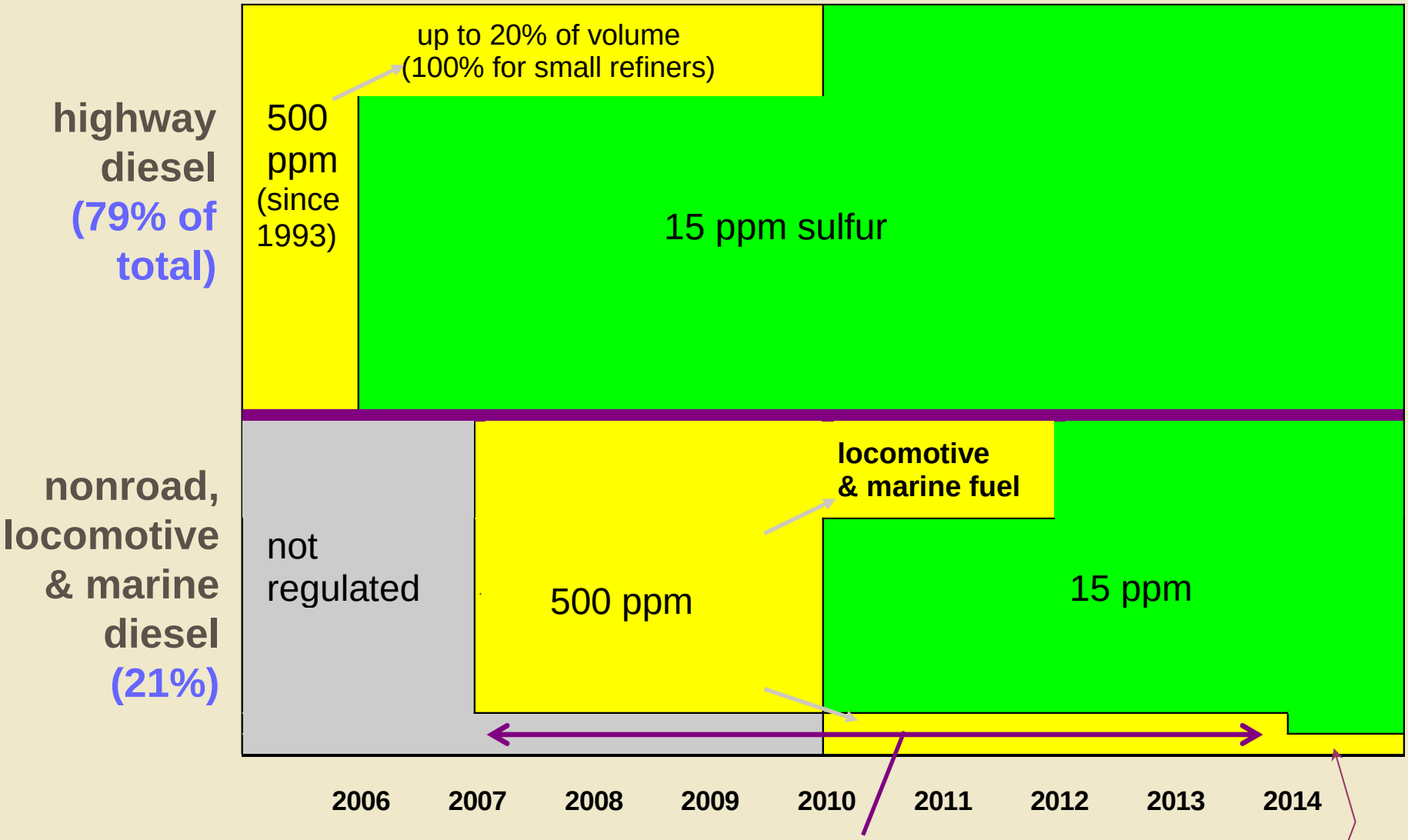
- **Diesel aftertreatment**
  - Stringent new standards for NOx and PM
    - Reductions of >95% PM, ~90% NOx
  - Also new test requirements to ensure control in use

- **Fuel sulfur reduced to 15 ppm in 2 steps**
  - Enables the aftertreatment technologies
  - AND gets large immediate sulfate PM reductions from existing fleet
  - AND lowers engine maintenance costs
    - sulfur acidifies oil, corrodes engine parts
    - benefits owners of new *and old* equipment



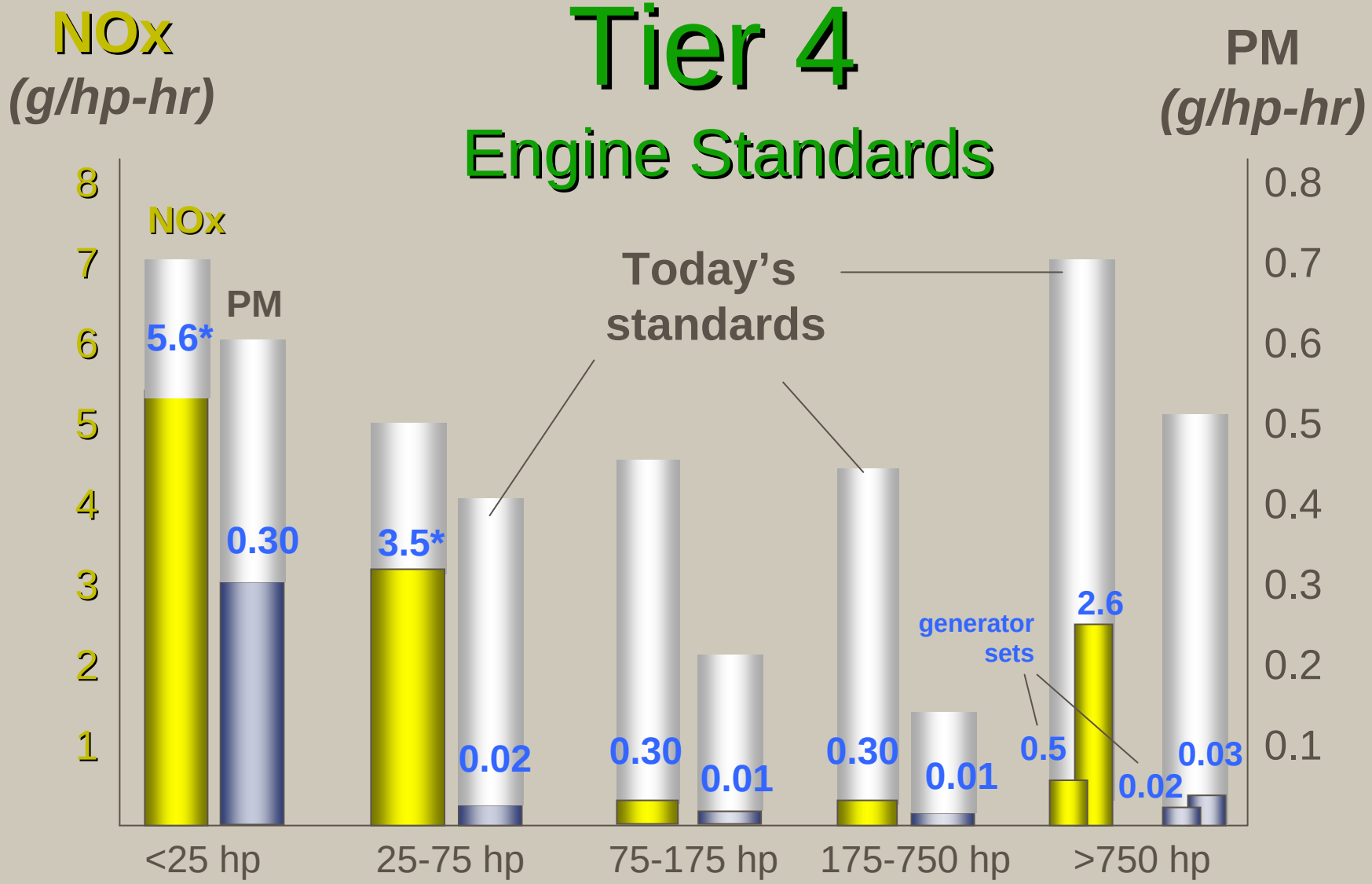
EPA Regulation of Diesel Fuel Sulfur

Regulations apply June 1 at refinery, Aug 1 at terminal, Oct 1 at retailer



for transmix, small refiner fuel, and thru use of credits, except in Northeast & Alaska
(expiration date not yet set for 500 ppm locomotive & marine transmix)

Tier 4
Engine Standards



** This is a combined NOx + hydrocarbon standard*

A vivid demonstration of what this is all about

- Typical test filter – current standards
- Test filter – Tier 4 PM standards
- Unused test filter

Cost Impacts

Vary with Engine Size and Equipment Application

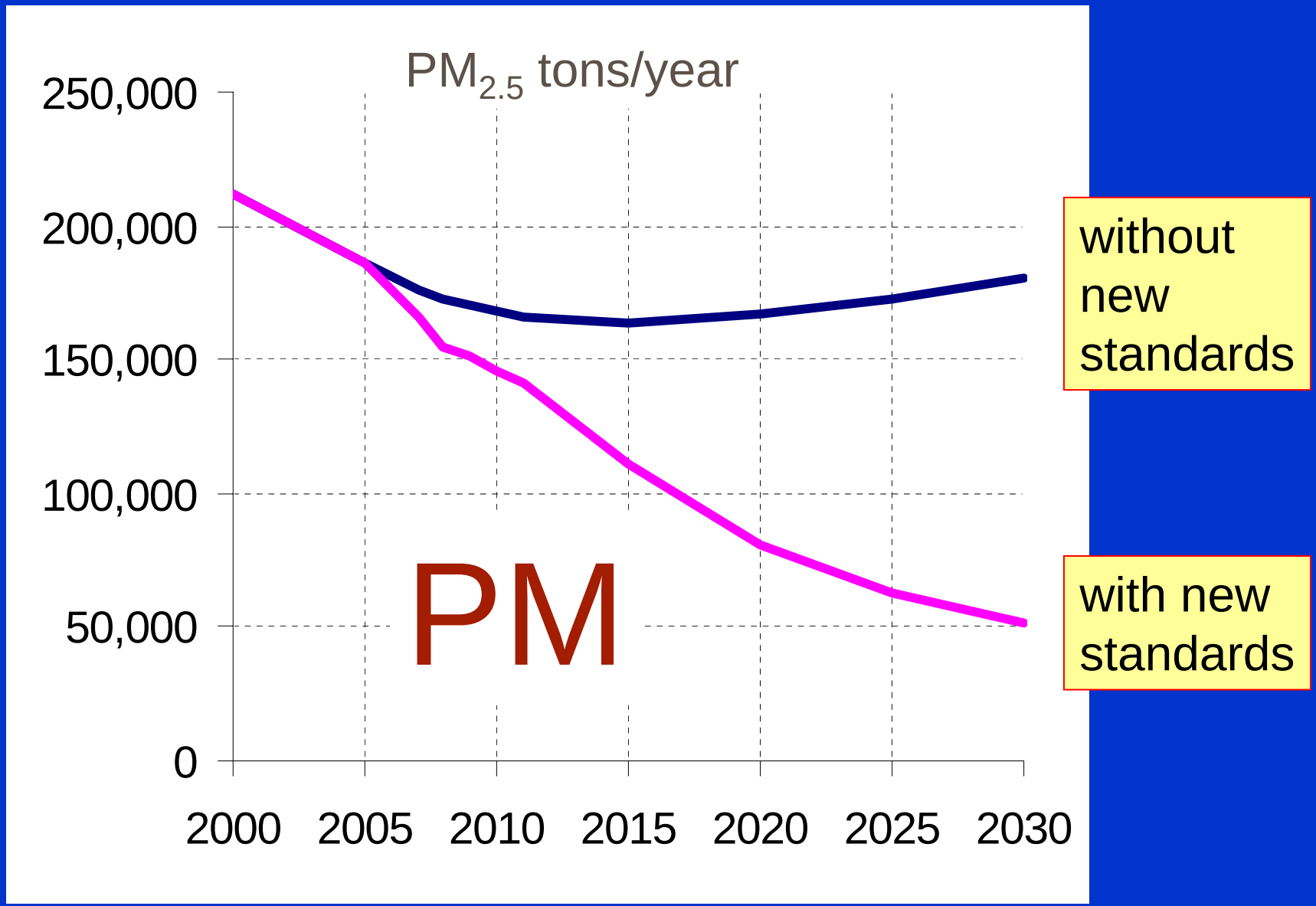



	Skid Steer Loader 33 hp	Backhoe 76 hp	Dozer 175 hp	Off-Highway Truck 1000 hp
Long-term cost of meeting new standards	$790	$1200	$2560	$4670
Typical retail price of this equipment	$20,000	$49,000	$238,000	$840,000

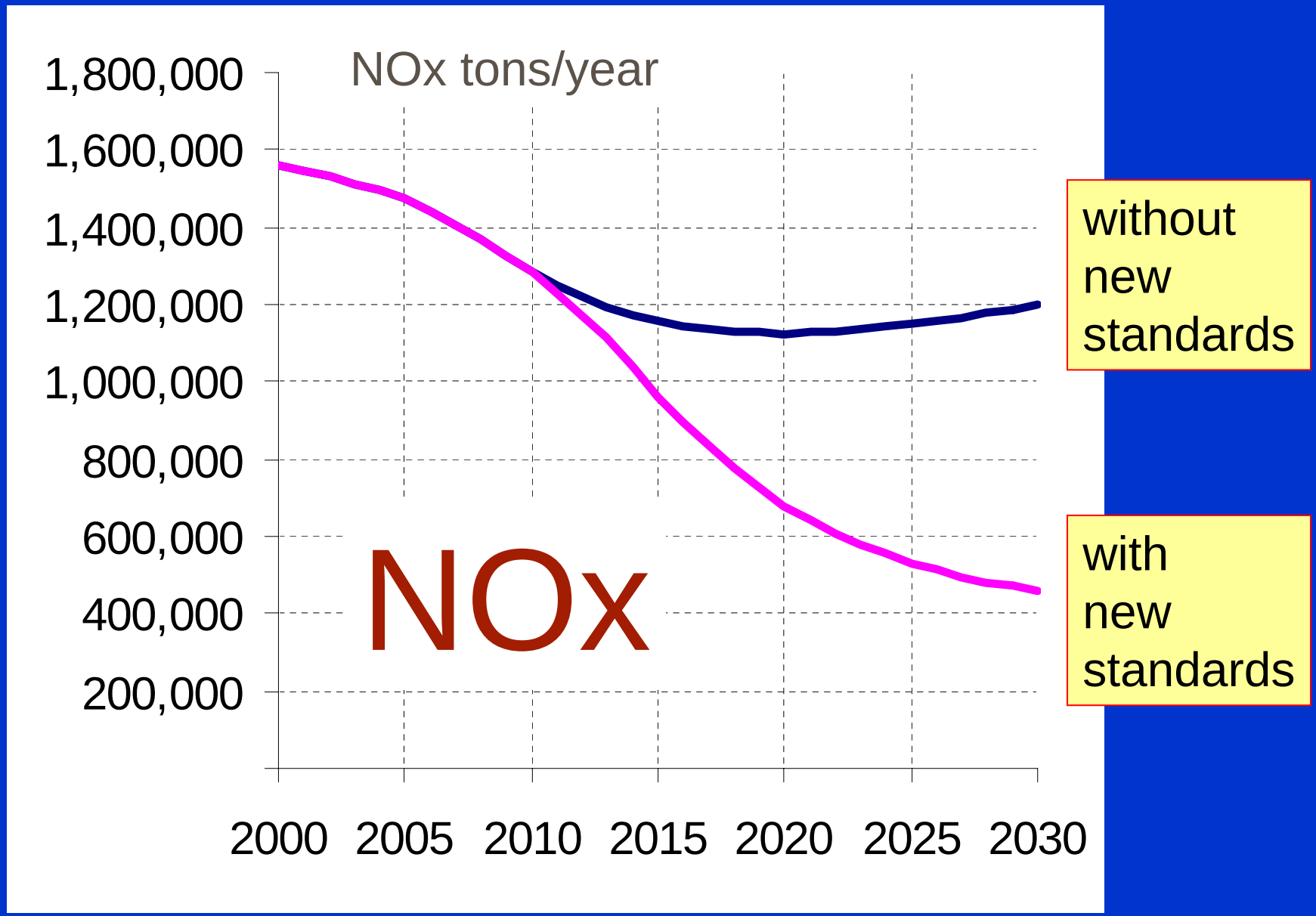
Diesel Fuel Refiner, Distributor, & User Impacts

- Average fuel cost (refining & distribution): **6-7 ¢/gal**
- Maintenance savings to nonroad equipment owner from cleaner fuel: **~3 ¢/gal**
- Net consumer cost of fuel change: **3-4 ¢/gal**

Nationwide PM Reductions From Nonroad Diesels



Nationwide NOx Reductions From Nonroad Diesels



Nonroad Diesel Health Benefits

premature deaths — 12,000

nonfatal heart attacks — 15,000

ER visits by kids w/ asthma — 6,000

hospital admissions — 8,900

lost work days — 1 million

0 10,000 20,000

prevented annually (in 2030)

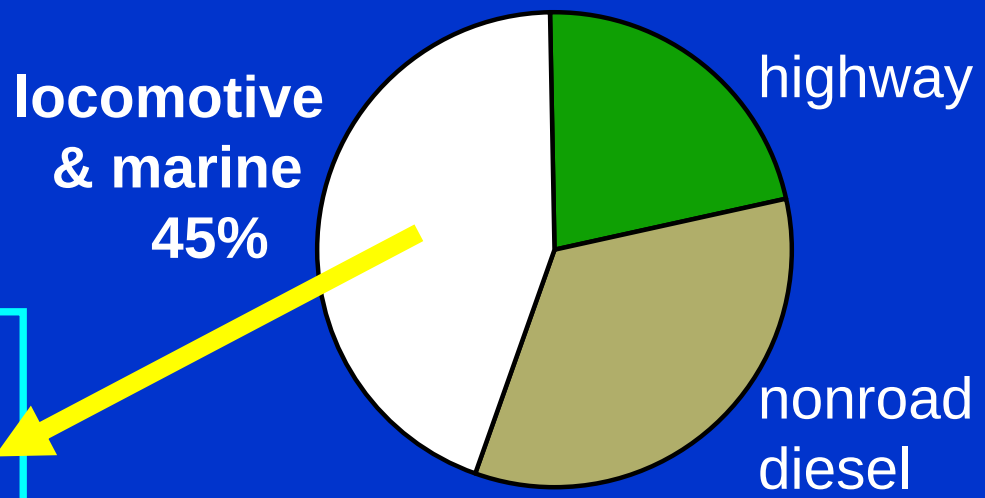
$80B annual benefits vs $2B cost (in 2030)

Controlling Emissions From Locomotives and Marine Diesel Engines

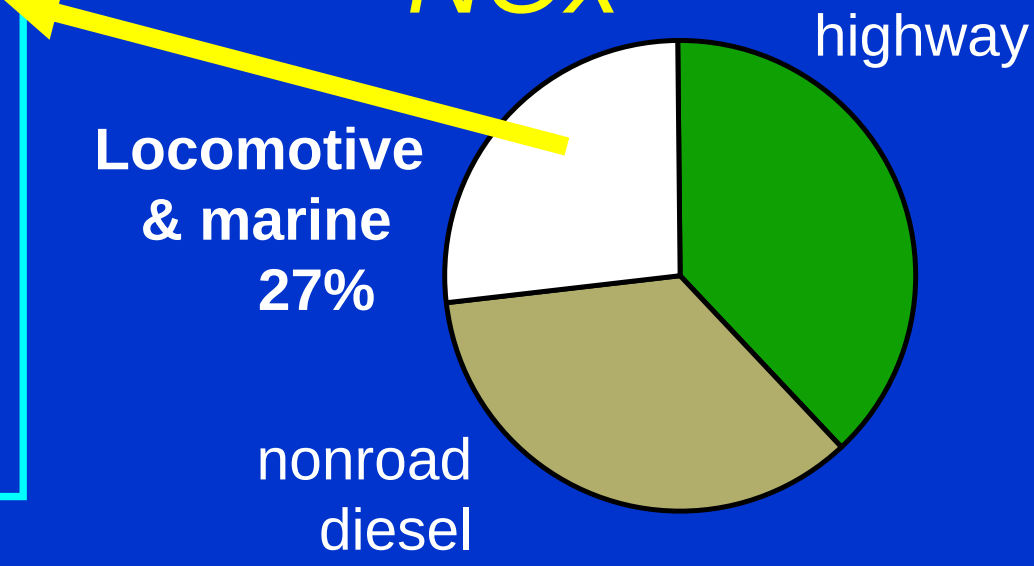
Mobile Source Inventories in 2030

- Potential reductions on the order of:
  - ~25,000 tons/yr of PM
  - ~900,000 tons/yr of NOx
- Compares to nonroad rule reductions of:
  - ~129,000 tons/yr of PM
  - 738,000 tons/yr of NOx

Diesel $PM_{2.5}$



NOx



Locomotive & Marine Diesels Advance Notice

- Advance Notice signed May 11
  - Targets high-efficiency aftertreatment
  - as early as 2011
  - Patterned after highway and nonroad programs
  - Not ocean-going vessels (separate EPA action)
- Comment period open to end of August
- Starting to engage stakeholders in discussions
- Proposal planned for mid-2005